



Programme financé par  
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# PROCAMED PROJECT

## Intermediate mid-term workshop report

**28-31 October 2013**

**Bari, Italy**

**B. Faye, G. Lacalandra, D. Monaco, Kh. Bhrawi, T. Khorchani**



CIRAD-EMVT 2013

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## **ABSTRACT**

The intermediate workshop of PROCAMED project was hold and organized at Conversano and Bari by the University of Bari according to the workplan of the project. This workshop included 3 events: (i) a seminar on “the dromedary camel as a domestic producing animal” (28 October) presented at the university with the presence of hundred students approximately, (ii) the project intermediate seminar itself (29-31 october), and (iii) training course (3-6 November) on “dromedary camel health and diseases and veterinary cooperation in developing countries”. The present report is focused on the two first items. The seminar presented the state of the art regarding camel research with a special focus on camel reproduction. The intermediate seminar was the occasion for presenting the advancement of the different activities of the project by the different partners and overall to find the way for a better cooperation and interactions between the partners, especially between Tunisia and Egypt. The meeting was finished by recommendations for the next activities in 2014. A field trip was then organized (visit of buffalo farm including farm processing).

**Keywords:** camel, reproduction, research, project, partnership



## INTRODUCTION

The intermediate workshop of PROCAMED project was hold at Bari as it was expected by the workplan. It was organized within several events contributing to the promotion of the project and to the training activities registered formerly in PROCAMED. The first event was the organization of a scientific seminar on “the dromedary camel as a domestic producing animal” (28 October) presented at the university with the presence of hundred students approximately. The content of the seminar is reported in annex. It was the occasion for presenting some results acquired within the project, especially in the field of anatomy, reproduction, genetic and milk processing. The second event was the intermediary workshop itself (29-31 October) which was the occasion of a wide exchange between the partners and to weight the strength and the weakness of the partnership. The third event was a training course on camel diseases. The content is also given in annex. It was open to the students from University of Bari in addition to the Egyptian and Tunisian participants. The present report is focused on the intermediary workshop.

The objectives of the intermediate workshop were:

- to share information regarding the advancements of the different activities of the project by each partner by giving notably some preliminary results
- to propose the activities for the year 2014 and establish the annual workplan
- to discuss about the difficulties and the weakness of the project in order to find solutions
- to share information regarding financial statement and budget preparation
- to establish a list of recommendations for improving the quality of research and partnership



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## I - Organization of the Workshop

The workshop was held at the conference room of the Museum pole of Monastery San Benedetto, at Conversano, a small town close to Bari in Italy. As a whole, 23 people participated to the workshop including 7 Tunisian partners, 4 Egyptian partners and 2 French partners in addition of the Italian.

It was organized over 3 days including one day for technical aspects, one day for financial aspects and recommendations, and one day for field visit (visit of buffalo farm processing the milk into cheese) in the Puglia region

The participants being in the same hotel and sharing all their lunches, the exchanges were possible out of the conference room. Globally, the organization was well done and appreciated by the participants. The welcome speech was done by the mayor of Conversano town and by Pr G. LACALANDRA as inviting party.

The contributions to the workshop were presented by B. FAYE (CIRAD, France, Coordinator), Kh. BAHRAWY (DRC, Egypt), T. KHORCHANI (IRA, Tunisia), D. MONACO (Univ. Bari, Italy) and E. CIANI (Univ. Bari, Italy) for technical aspects. For financial aspects, S. JANSSEN (CIRAD, France) has presented also a PowerPoint. The presence of a representative from AGC (Mr Fabrizio FLORIS) was expected, especially for the questions regarding the budget, but it was not possible. All the participants have regretted this absence.



*Welcome speech by the Mayor of Conversano and Pr Lacalandra*

## II - Presentation of the coordinator (B. FAYE)

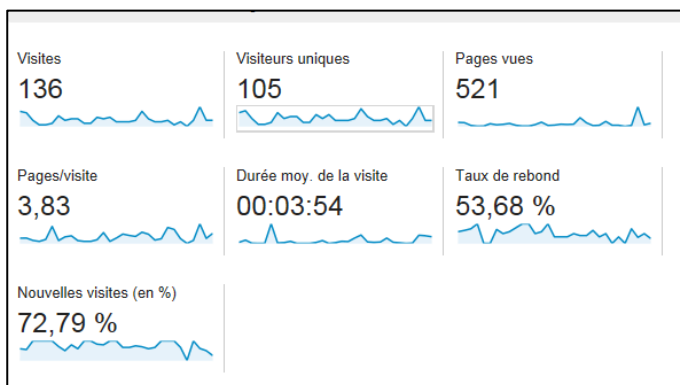
The role of the coordination was recalled. It includes (i) the facilitation of the links between the partners, (ii) the collection of the information on the activities of the project to achieve the intermediary reports, (iii) the support of the opportunities (stages, conferences) within the frame of the budget, (iv) the monitoring of the achievement of the workplan, (v) the management of the communication tools (website, facebook address....). After the recall of the advancement in the different activities in general, the strengths and the weaknesses of the project management were presented. The **strengths** are:

- The good advancement of the activities in spite of the political situation in Egypt and Tunisia
- The increasing involvement of the activities with the partners of the development sector regarding the transfer of the innovations to the users
- the achievement of some publications
- the regular email contacts between the partners (a list "Procamed" is available)
- the good interactions between the partners from Europe (France, Italy) and those of South (Egypt, Tunisia)
- a good participation to workshops and conferences (Muscat in Oman, London in UK, Khartoum in Sudan, Al-Hassa in Saudi Arabia)
- an operational website

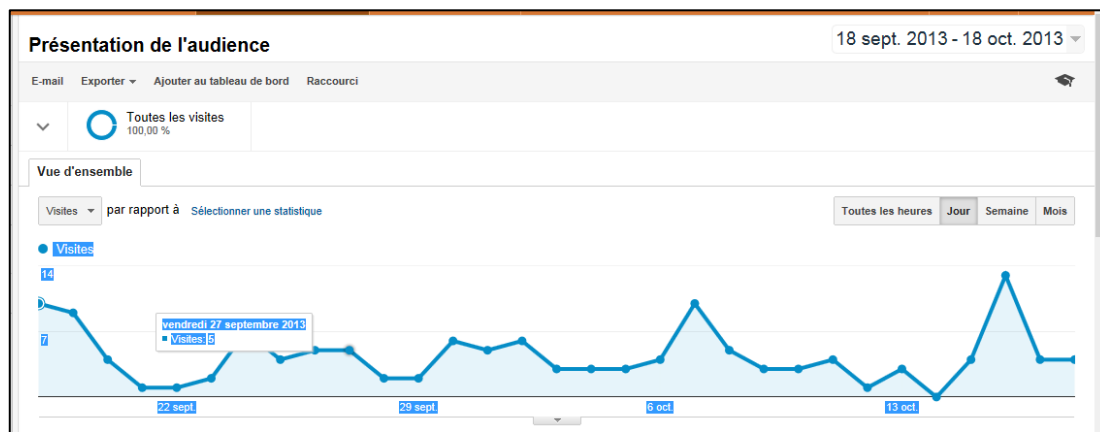
At reverse, the weaknesses identified by the coordinator were:

- the lack of information regularly sent to the coordinator regarding the advancements of the activities
- the lack of interactions between the partners "south-south" and in consequence the absence of really common activities
- the weak request of the expertise from CIRAD in the different field (epidemiology, agrostology, economy, demography, etc...)
- the insufficient collective discipline in the budget expenses to reach 70% approximately in the same time
- the late receiving financial reports
- globally, the communication regarding the project which could be improved

For example, regarding the communication, the presentation reported the state of the visits on PROCAMED website (analysis achieved by Google-analytics).



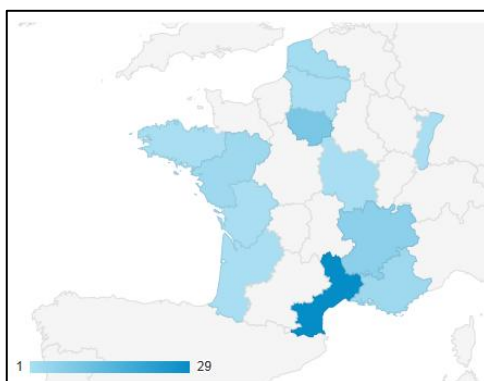
*Statistiques of the visits on website  
<http://procamed.cirad.fr>*



**Daily audience of PROCAMED website (1- 15 visits per day)**



**Geographical origin of the visitors (from 1 visit in Egypt, to 12 in Italy, 28 in Tunisia and 58 in France)**



**In France, the visitors came in majority from Languedoc-Roussillon region where the coordination is.**

The low consultation by Egypt is linked to the main language used in the website (French).  
Some solutions were suggested to improve the management of the project:

- to reinforce the communication between the partners and the coordination by fulfilling a table (prepared by the coordination) every 3 months regarding the activities in order to give back the activities report to EU

- to support the exchanges between partners especially between Tunisia and Egypt (a mission is expected before the end 2013)
- to organize the surveys to achieve the objectives regarding socio-economic and environmental aspects
- to determine a strict calendar for expertise support from CIRAD

Then the list of activities for 2014 were presented and discussed. It has been recalled the necessity to establish the list of publications mentioning PROCAMED, to prepare papers for a special issue in Emirates Journal of Food and Agriculture, to provide information for the website and to give regularly information on the advancement of the activities.

### **III - Advancement of the activities of Italian partner**

#### **❖ Camel Reproduction**

The Italian partner (University of Bari) is working on different field/topic related with reproduction including anatomy, management/sexual behavior/welfare of males, biology of reproduction and biotechnology of reproduction.

Regarding anatomy, presented by Pr. DESANTIS, 3 topics are investigated: (i) Studies on the changes of the placental-uterine surface during pregnancy, (ii) Studies of the glycan pattern of the fallopian tubes during the different phases of the oestrus cycle, and (iii) Collection of many specimens for further studies (umbilical chord, Glycan pattern of the uterus). Other investigations (morphology and chemical composition of oviduct, uterus and ombilical cord) will be implemented. For biology of reproduction (D. Monaco), 4 trials are in course: (i) preliminary trials about synchronization of females, (ii) optimization of the semen collection through artificial Vagina, (iii) semen evaluation, (iv) first trials on semen liquefaction and extension. Two activities are performed on biotechnology of reproduction: (i) In vitro maturation of oocytes, and (ii) vitrification of the oocytes (first attempts).

Obviously, all these activities are achieved in close collaboration with DRC and IRA and was based on several exchanges of students

- Degree Stage (Master thesis) Mrs BENEULT B. (Supagro, France)
- Degree Stage (Master thesis) Mrs. CIANNARELLA F. (Univ. Bari, Italy)
- Stage Mrs AUBÈ L. (Tunisia–Italy)
- On going work for PhD Thesis of Mrs FATNASSI (Tunisia)

Elsewhere, 4 papers are already published or submitted (Sexual behaviour, stereotypes, Anatomy/biotechnology of reproduction) and one is in preparation for submission (sexual Behaviour). Also, 2 communications were presented to the Italian society of Animal reproduction Congress (S.I.R.A.) 2013 (Biology of Reproduction), 2 communications at ISOCARD2012-Oman and Congress of the Italian society of anatomists (camel anatomy), and one communication at the Conference of Sustainability of Camel Productions in Saudi Arabia

(biotechnology of reproduction). Other presentations were done in FAO workshop in Mauritania and in a conference on camel in London.



*Demonstration of the use of artificial vagina for semen collection in camel by Dr Monaco (FAO workshop, Mauritania)*

Regarding the expected activities for the next year, it has been suggested: (i) to test the effects of Pyr/VB addition in IVM on fresh oocyte developmental potential by Intra cytoplasmic sperm injection (ICSI), (ii) to test the effects of Pyr/VB addition in IVM on post-vitrification oocyte survival rate by Intra cytoplasmic sperm injection (ICSI), (iii) to test Pyr/VB effects (treated vs control) by OMICS and/or 3D imaging technologies, (iv) to implement a cooperation with an expert from Utrecht university for carrying out semen freezing and importing semen in Europe (comparison between A.I. trials in Tunisia and Semen Evaluation in Europe), (v) to test artificial insemination both in Egypt and Tunisia, (vi) to test the evaluation and stimulation of male sexual behavior through female parade and semen collection, (vii) to study the circadian rhythms of testosterone and cortisol in dromedary camel; correlation with sex, management and breeding season, (viii) to evaluate the effect of transport of physiological and behavioral parameters in dromedary camel, (ix) to test the effect of different management system on behavior: correlation with semen quality, (x) to test the effect of different management systems on rutting behavior and behavioral repertoire of male dromedary camel, (xi) to evaluate the effects of GnRH administration on LH and testosterone profile and on libido and sexual behavior captive male dromedary camels.

All these activities could be sufficiently informative for improving the camel productivity as it was expected through PROCAMED project. Finally a workshop on reproduction could be organized at the end of the project.

### ❖ Camel genetic

The activities regarding genetic were presented by Dr E. CIANI. It involved the genetic characterization of the camel population by different approaches:

- Oligonucleotide primer pairs purchased from MWG/OPERON following the protocol of Dr. FAISAL ALMATHEN (KFU- SA).

- Qiagen Multiplex PCR Kit used in the Multiplex PCR optimization steps.
- Multiplex PCR protocol from Dr. Faisal Almathen (KFU- SA) optimized to current running conditions in Italy, adjusting primer concentration and thermal protocol (30''X95°C; 90'' X 60°C; 60'' X 72°C; 30' X 60°C; 25 cycles).
- Optimization carried out on 5 samples from Tunisia (CD1-5).

Regarding the camel in **Tunisia**, 310 samples were achieved. It appears that the locus CMS17 was monomorphic on the 5 phenotypes identified in Tunisian samples. For the samples from **Egypt**, a first delivery of 78 samples from the Marsa Matruh Governorate was obtained but there was a too low DNA concentrations. A second delivery of 150 samples from the Marsa Matruh Governorate with enough DNA concentrations were obtained. Up to now about 30 samples have been genotyped, selected from the three sampling area. A wider sampling effort was expected in Egypt through collaboration out of DRC. In order to have a convenient view regarding camel diversity, samples from Algeria (not on PROCAMED budget) were analyzed also in the frame of PhD.

Preliminary results were presented at the conference of the Italian Society of Animal Reproduction.

In January 2013, a training session (10 participants from Tunisia, Egypt and Algeria) was organized at Medenine «Utilisation des marqueurs moléculaires pour l'analyse de la diversité génétique des populations animales d'élevage» (Institut des Régions Arides de Médenine, 7-9 january 2013). The session included a pre- and post-training evaluation questionnaires. The main critical aspects were (i) the heterogeneity of trainees, and (ii) the teaching language (combined English/French). In consequence, the planned teaching programme was modified.

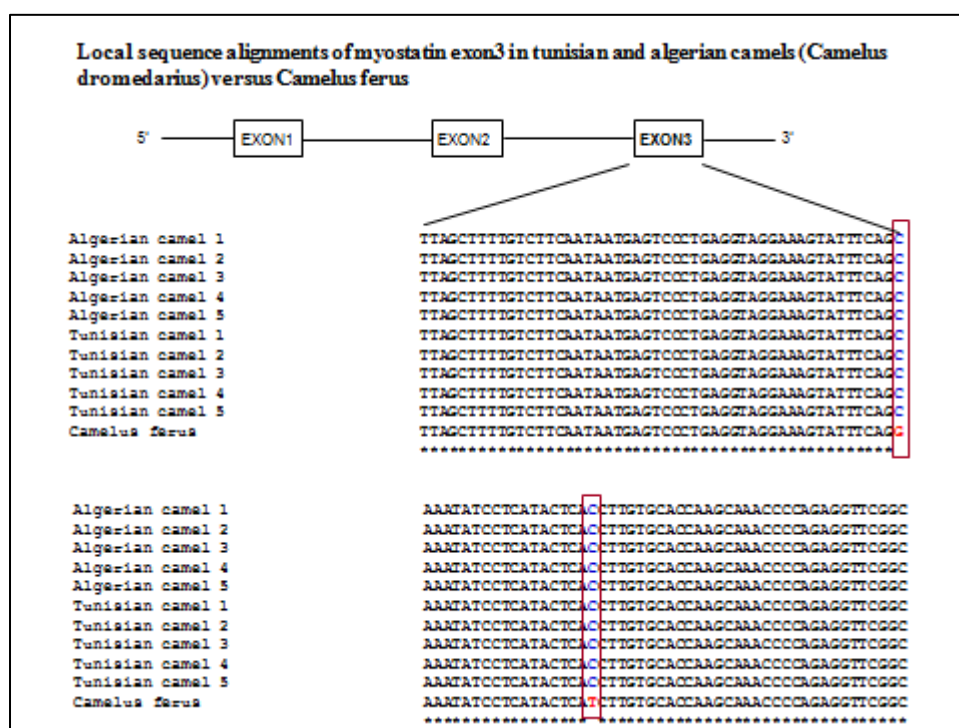


*Some participants to the workshop on the use of genetic markers (Medenine, January 2013)*

A specific focus was done in the presentation regarding genetic activities on the sequencing of myostatin gene in the camel. This activity is based also on a large collaboration of all partners of PROCAMED and other countries. Three exons were investigated and it appears a local sequence alignment of myostatin exon1 and 3 in Tunisian and Algerian camels, and of exon2 in Algerian camel. A similar alignment was observed for intron1 and intron2 in Algerian and Egyptian camels. The next activity will be to complete exon sequencing for exons 1, 2 and 3 for all samples (Egypt, Tunisia, Algeria, Mauritania, Sudan, Saudi Arabia and



possibly Oman) and to obtain the 5' and 3' sequences, in order to design primers in this region, amplify and sequence in all the available samples.



*Example of Local sequence myostatin gene  
in Algerian and Tunisian camel breed*

## IV - Advancement of the activities of Tunisian partner

The Tunisian activities were presented by Mohammed HAMMADI. The Tunisian partner has recalled the institutional context of the PROCAMED project in Tunisia, especially the strong relationships with the organization for development and for agro-industry innovation. Several informative were organized in the different eligible regions and a total of 116 persons participated to these meetings. Then the advancements in the different activities were presented.

### ❖ Camel reproduction

As the main activities regarding the reproduction were achieved in close collaboration with the University of Bari, there was overlapping in the presentation and some of the activities were repeated. Many trials were performed in Tunisia, regarding sexual behavior and heat synchronization. It will be not repeated here.

### ❖ Camel genetic

Similar remark could be done for genetic characterization which is implemented in close collaboration with University of Bari. In addition to the results presented by E. CIANI, other

activities regarding genetic was achieved, notably the establishment of a simple system to control pedigree and performances by electronic identification of pilots herds ( $n = 300$ ) with RFID bolus in the rumen (the trial was achieved on experimental herd of IRA , $n = 23$ ). The retention rate and treading rate was 100%, and an informative meeting will be organized for the technicians of development organizations (OEP and CRDA) as well as the breeders in December 2013. The application among the private farms will start in January 2014.

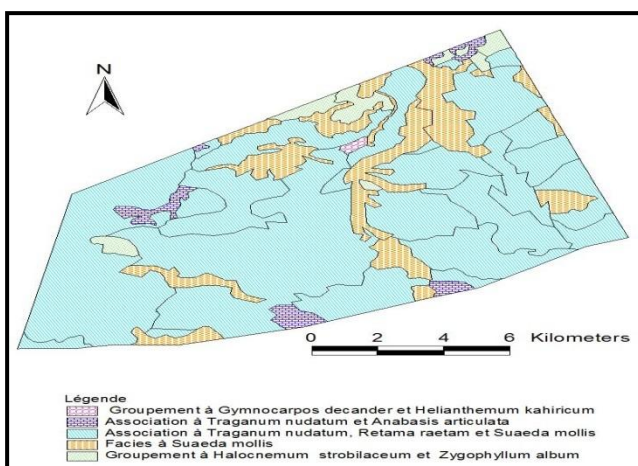


*Introduction of electronic bolus for automatic identification of the camel*

This identification campaign must help to set up the pedigree and performance control in pilot herds ( $n=300$ ). Elsewhere a study on camel milk protein genes was almost achieved. It includes (i) the milk and mammary gland tissue sampling for extracting RNA and establish a cDNA library, (ii) the identification and characterization of specific camel milk protein genes.

### ❖ Nutrition and health

A field survey in camel dairy farms was implemented in order to characterize the feeding system, estimate the nutritive value of the diets used for dairy camel and evaluate the impact of the type of diet on the milk yield. Due to administrative constraints, the importation of NIRS (Near-Infra-Red Spectrometer) for evaluating the nutritive values of plants in range is postponed as well as the training by a technician from CIRAD. However the mapping of pastoral resources (phytoecological map) is started and 57 samples of vegetation were done according to their spatial distribution.



*Phyto ecological mapping of the range resources for camel*



Regarding health survey, 163 camel farms were investigated in different farming systems (from extensive to intensive settled farms) to identify the main disorders and propose adapted methods of treatment against external parasites. Equipment for tick control by spray was distributed in this aim and proper use was learned to the farmers.



*Convenient use of  
spray for tick control*

A meeting session (36 participants) was organized with the breeders of the eligible regions on the health care in camel farms. A communication (coprological diagnosis) was presented in the International camel conference in Saudi Arabia (Feb. 2013).

### ❖ Milk and meat production

The adaptation of camel to automatic milking with specific machine is an important challenge for the development of intensive dairy farm. Preliminary researches were implemented regarding anatomical and physiological adaptation of the camel to milking machine. These researches included morphological studies (Correlation between morphometric parameters and milk flow traits, udder morphometric evolution before and after milk ejection occurrence, cisternal size and milk partitioning in the udder according to lactation stage) and milking management studies (determination of the appropriate vacuum level and pulsation rate for camels, effects of udder pre-stimulation vs stress on milk ejection and milk removal). In term of development, milking machines were distributed to camel dairy farmers ready for integrating the milk market.



*Distribution of milking machine in  
camel dairy farm*

Some activities have started also to introduce new dairy products having health effect on consumers. To evaluate this effect, the antioxidant and inhibition activity of conversion of

angiotensine I enzyme (activity anti-hypertensive) in fermented camel milk by proteolytic bacteria *Streptococcus thermophilus* (the second most used lactic bacteria in food industry) was analyzed. It was shown that this bacterium has strong proteolytic activity leading to polypeptides release in fermented milk with “anti-free radicals” activity.

Regarding meat production, the project of implementation of feed-lot for camel fattening is postponed until the situation with Libya will not change. Indeed, a massive transfer of animal herds (different species along with camels) occurred since the last 2 years to Libya caused by a very high price of animals and a lack of border control. So, we assist to an immediate sale of calves after weaning which became very precocious.

### ❖ Skin and wool

The technical innovations in skin and wool treatment are an important outcome of the project and are based with subcontracting with professional partners like CNCC (National Center of leather and shoes) or the Institute of Textiles. The project contributed to the collect, frozen storage and tannery reagents purchase before the finishing process expected at the end of the year 2013. Fine products will be made in 2014, but still now an exhibition is available at IRA (photo enclosed) in the enterprises’ incubator, and informative meeting was organized in January 2013 (enhancing the value of camel hides). Similar approach was developed for camel wool (collect of the wool, purchase of electric mowers, manufacturing of Bedouin products with camel wool, informative meeting on “enhancing the value of camel hair”).



*Fine products made in camel leather*

### ❖ Economy of the camel households

The place of camel in the household economy was studied through a survey managed by a master student from CIRAD (see “activities managed by CIRAD”). This study has to be completed by the analysis of the added-value chain in meat sector (a PhD in co-supervision France-Tunisia is expected).

## V - Advancement of the activities of Egyptian partner

Presented by K. BAHRAWY, the activities of the Egyptian partner covered a wide range of tasks. After recalling the difficulties due to the political situation in Egypt with direct impact on research activities (insecurity in field areas, vandalism, strikes,...), the presentation was focused on the partnership with local institutions for development, the management of the project locally. After the launching meeting of the project at Djerba in 2012, a starting seminar was organized in Marsa Matrouh in March 2012 for the camel stakeholders (42 camel breeders, governmental authorities, regional livestock associations and media) in order to present PROCAMED project.

### ❖ Reproduction

As for Tunisian partner, most of the activities regarding reproduction were achieved in close collaboration with University of Bari. The activities developed in that frame are (i) the production of camel embryos using intra-cytoplasmic sperm injection (ICSI) including different steps like sampling of camel ovaries at the slaughterhouse, searching for oocytes, incubation and maturation then ICSI, the objective being *in-vitro* fertilization (ii) preparing reliable synchronization of ovulation protocols including different steps also as semen collection, estrous synchronization, follicular growth stimulation and induction of ovulation, then artificial insemination with cryopreserved semen doses, pregnancy diagnosis and control of hormonal profile.



*Artificial insemination in camel*

Further activities were defined: (i) Refining a PMSG-based synchronization of ovulation protocol in dromedary she-camels out of the breeding season, (ii) Ovarian kinetics of dromedary she-camels following active immunization with a transforming growth factor, (iii) Male breeding season elongation.

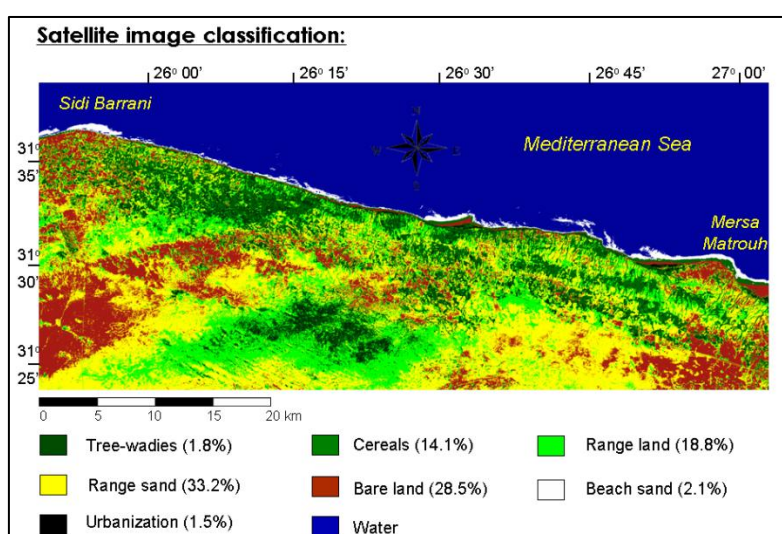
### ❖ Camel genetic

It was just recalled here the contribution of Egyptian partner in blood sample collection for DNA extraction and shipping to University of Bari. However, one Egyptian scientist participated to the training in Tunisia on molecular genetic tools. The collaboration with

University of Bari was also extended to the camel meat sampling for myostatin gene identification as reported above.

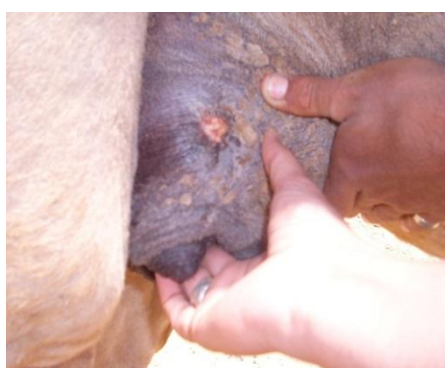
### ❖ Nutrition and health

Contrary to Tunisia, there was no NIRS apparatus commended in Egypt. The nutritive value of range which was one of the activities to perform within the project was approached in Egypt by a preliminary inventory of the pastoral resources. A field survey during the late winter and spring season in representative range sites along the Mediterranean coast was achieved and 128 plant species were recorded and analyzed (proximate analyses, minerals, anti-nutritional factors, nutritive values). The exchanges with Tunisian partner when the NIRS will be provided are encouraged. This work is completed with field survey using remote sensing in order to get a proper cover of pastoral resources



*In the second step, the GIS will be completed with soil analyses*

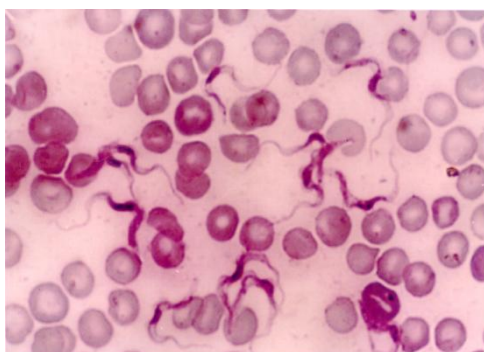
Regarding health monitoring only survey on the type of diseases occurring in camel was done, but it is not clear if the questionnaire was properly analyzed. Training on survey statistical analysis will be organized in January 2014. However, the field survey already done give the possibility to facilitate the transfer knowledge during field communication.



*Veterinary field survey*



The camel health is also approached by laboratory aspects. In that context, a study of the prevalence and genetic variation of the agent of camel trypanosomosis (*Trypanosoma evansi*) is in course. This study includes the evaluation of the prevalence and of the distribution of the disease (one of the main health constraint in camel) during the first year study (including diagnosis tools implementation), the assessment of the genetic variability of the parasite by molecular tools (second year survey). For the multiplication of the parasites, groups of mice were infected, their parasitaemia level observed daily and the stocks isolated and purified before DNA analysis. During the third year, the anti-trypanosomosis activity of plant extracts and essential oils will be tested.



*The trypanosomes DNAs will be extracted, purified and precipitated using DNA purification kits for whole blood and isolates. Then amplified and detected for the presence of T. evansi DNA.*

Another activity regarding health aspect is the Production of vaccines against different infectious diseases in camels by recombinant DNA vaccine sequencing technique. Elsewhere, the monitoring and evaluating immunity of the DNA vaccine-treated camels against different pathogens will be tested. The first pathogen tested was *Brucella melitensis*. The preliminary researches included 2 steps: (i) extraction of genetic material (DNA) from *Brucella melitensis* 16M by different methods, (ii) quantification and purification of DNA measured by NanoDrop spectrophotometer. The best method of extraction was CTAB method.

### ❖ Milk and meat production

The manufacturing of new camel milk products is supervised by a PhD student. At the mid-term of the project, the following items were performed: (i) manufacturing of White Soft Cheese from Camel Milk, (ii) production of soft cheese from camel milk, (iii) determination of the chemical composition of cheese and sensory evaluation, (iv) the influence of proteins cross-linking enzymes on soft cheese properties made from camel's milk, (v) the determination of the chemical composition and microbiological analysis of fermented milk and bio-fermented milk during storage and sensory evaluation. A communication on cheese production was presented at the conference in Saudi Arabia.



*White camel cheese production*

The application of new technology to improve the camel meat quality and availability was also in course. Eleven growing one-humped male camels (3 Maghrabi and 8 Sudani) ranging 24 to 30 months of age with average body weights of  $348 \pm 19.5$  kg, were used in this study. Camels are accomplishing their fattening period to be slaughtered for meat quality analysis measurements. Two steps after blood sampling are in Progress: (i) DNA isolation and performing polymerase Chain Reaction (PCR) using restriction fragment length polymorphism methodology after PCR (PCR-RFLPs), (ii) sequencing of some PCR products. The expected results are (i) the identification of the number of alleles present for each gene under study, (ii) the correlation of the identified alleles (genotypes) with phenotypic data, (iii) the recommendation of specific alleles for marker assisted selection (MAS).

### ❖ Skin and wool

The objective for camel skin and leather innovation is to develop an environmental-friendly tanning technique that can be effectively used in tanning different types of camel leathers, then to conduct an economical evaluation and assessment of the efficiency of the proposed tanning technique compared to traditional tanning methods. The camel leather is not utilizing correctly in Egypt. It mainly used for making limited products in desert areas such as whips and saddles and to make a gourd-like container for water and milk. Secondly, it is difficult to collect and transport from desert areas to tannery. Moreover, the tanneries do not use it for its disadvantages such as surface burn marks and diseases. For the moment, the research was focused on water management. Chrome recovery and re-using natural fats will be done in the next period of the project.

For the camel wool production, the focus was done on the loom which is usually huge, needs a lot of space, is difficult to move, and needs huge effort and special skills to work on it. A modified loom was proposed in order to increase the work productivity, increase the number of loom in one room, decrease the painfulness of the work and allow increasing the mechanical speed.

## ❖ Adoption of the innovations

In the first step, a survey was achieved to appreciate the ability of transferring innovation in Bedouin society. A questionnaire was prepared for this study to give an idea about the real knowledge of the camel breeders about new technology and their ability to try these new technologies in their herds. Several 3-days training were organized in different field (Health and veterinary care, nutrition, dairy processing, technologies of reproduction,, new hair sharing methods, camel hides preparation) and as the whole 60 people participated (breeders, technicians, students) the first year of the project and 75 the second year.

A 3-days training was also organized specifically for the camel breeders in the 3 locations of the project area on new technologies (AI, ultrasound, milking machine, feed blocks, silage, etc...). More than 100 breeders attended the course.



*Training of camel breeders: The training included educational banners and educational hard copy brochures.*

*A questionnaire was applied to have an idea about the best technologies that the camel farmers need and the extension program to be used. Here, the milking machine*



## ❖ Camel economy

The camel demography, the socio-economic survey, the added-value chains are all activities receiving one-week training in France in July 2012. However, as for Tunisia, these activities are difficult to implement properly for technical reasons in spite of several exchanges with CIRAD experts.

## VI - Advancement of the activities managed by CIRAD

Only the scientific activities are reported in this chapter. CIRAD intervenes in support for all activities as nutrition (training for proper use of the NIRS), range management, animal production, epidemiological study and overall on socio-economic aspects. But few expertises were solicited for the moment. One of the main research activities to be managed by CIRAD is the socio-economic surveys. All the partners were trained at Montpellier in July 2012 as said already above. Three main surveys have to be launched: (i) a survey on the economy of stakeholders, (ii) a camel demography survey, and (iii) an added-value chain analysis regarding camel production. A master student from CIRAD was mobilized to manage the first survey in Tunisia.

### ❖ Role of the camel in the household economy

The planned survey was achieved and preliminary results for estimating camel's contribution to the household economy were obtained. But, there was a gap between the planned and the realized sampling. It was planned a random stratified sampling of 164 households representing 20% of the camel breeders. Eight surveyors (OEP and IRA) were expected. The final sampling was not representative: only 61 camel breeders with an imbalance between the regions (table 1).

Table 1. Gap between expected and realized sampling

Region	realized	Reality (census 2009)
Gabès	18 %	4 %
Kébili	12 %	22 %
Médenine	9 %	15 %
Tataouine	3 %	60 %

The survey was based on semi-structured questionnaire (characterization of household crop production and livestock, and financial charges regarding activities such as fattening, dairy production and tourism. According to the results 60% of the incomes are due to camel production, but this value is over-estimated due to the absence of small farmers in the sample and an exceptional year of destocking (not representative of an average situation). The animal feeds represented 74% of the expenses which is also over-estimated (the estimates were not weighted by household size). Other results: (i) the camel breeding occupy the most important place in the family work, and (ii) the importance of women's work depends on the size of the herd. However, there is a bias of over-representation of large herds in the sample. Finally, a sample adjustment for a better representativity of small herds and of Tataouine region could be suggested for completing the survey.



## ❖ Assessment of annual demographic parameters of camel herds

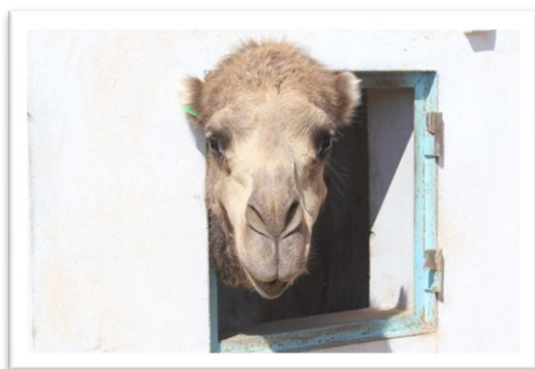
To estimate the camel productivity, we need to report the number of camels (official national statistics; estimation by province) and the average demographic parameters (sex-age structure – fecundity – mortality) so as to approach the herd productivity. To do that, there are 2 options: (i) literature review (but not sufficient data are available), and (ii) 12MO survey, method possibly replicated for several years to capture the between-years variability. The 12 MO demographic camel herds survey demands one visit of the herd (cross-sectional retrospective over the last 12 months), all animals available and could be done over 45 days out of the calving season. The investigators have been trained to the 12 MO method in April 2013, the literature review has been done and the collection of the number of camels per region was collected. Until now, 12 MO survey was not started. It appears a weak motivation of the partner to achieve it due to field constraints.

## ❖ Camel value chain analysis

The study was not started because the lack of data on the diversity of farming systems and marketing strategies. A Tunisian PhD student could engage this activity by a focus on camel meat.

## VII - Communication and diffusion

Those aspects were present all along the communication by the different partners. Visibility object were proposed as the 2013 calendar, and several participations to exhibition, conference and, workshops were the occasion to present PROCAMED. Communications in local media (newspaper, radio and TV) completed this activity of diffusion for the large public. The current list of publications is in annex.



*Cover photo of the  
PROCAMED calendar 2013*

*Home page of  
PROCAMED website*



Participation of PROCAMED to the Cairo International fair



## VIII - Financial situation

The financial aspects were presented by Sophie Janssen (CIRAD). However, some data were presented by the partners especially to say that some activities were delayed due to the lack of funds. After recalling the accepted budget at the beginning of the project, some minor modifications were presented:

- CIRAD budget: use of zootechnician budget for the implementation of the website (webmaster).
- DRC budget: biotechnology expert instead of environmental expert; microscope and dynamometer costs re-evaluated; travel costs for Oman instead of Saudi Arabia.
- Bari University budget: travel costs for Oman instead of Saudi Arabia.

Elsewhere, some modifications in the presentation of the budget were demanded by AGC which brought some delay. However, the main problem was the low expenses level at mid-term project (table 2) and the difference between partners.

Table 2. Level of expenses at mid-term PROCAMED project by the different partners

The next step regarding financial reporting is the sending of intermediate report (every 12 months, with data from the beginning of the action till the end of the period). The next one (09/01/2012 to 08/01/2014) must include

- Financial report of each partner with the cost occurred - cf. Annexe V.
- Audit certificate (« Rapport de vérification des dépenses ») - cf. Annexe III.

Partner	Budget	Eligible costs presented	%
CIRAD	486 133	142 010	29%
IRA	601 497	195 704	33%
DRC	587 367	111 890	19%
Uni de Bari	231 944	30 346	13%
<b>Total</b>	<b>1 906 941</b>	<b>479 951</b>	<b>25%</b>

- A payment demand – cf. Annexe V if the threshold of 70% is overtaken.
- In addition to these, the coordinator should give these same documents for CIRAD and with consolidated data.

Elsewhere, the monitoring is based on a bi-annual report: every 6 months, with data of the last six months and forecast of the next six months only. The next one will be for the period 09/01/2014 to 08/07/2014.

The collective discipline regarding the budget was quite difficult to manage due to the delay for reaching 70% of the expenses for all the partners.

## **IX - Final recommendations**

A final discussion was organized to propose some recommendations for all the partners:

- ❖ The final workshop of PROCAMED in 2015 will be organized in Egypt and it is suggested that it will be open to other camel scientists from Mediterranean countries
- ❖ The exchanges between the leader of each type of activities in the different countries must be more important
- ❖ The expertise South-South must be more developed
- ❖ The expected expenses for the next 12 months must be listed urgently
- ❖ The list of publications and reports must be centralized and up-to-dated regularly
- ❖ The consultation of the website must be increased with a better use by all the partners
- ❖ A technical steering committee must be organized in 2014
- ❖ The identification test of the camel will be tested in Egypt by Tunisian expert
- ❖ PROCAMED project must be widely present at the fourth ISOCARD conference in Kazakhstan in June 2015 (corresponding to the end of the project) by a strong action of visibility (stand, distribution of outputs)

## **X - Conclusion**

The activities in PROCAMED are going on in spite of the political situation in Egypt and Tunisia, lack of south-south strong relationship and sometimes difficulties in the communication (the language used in meeting is one of the difficulty). However, many activities were implemented and the first outputs are visible. However, if the technical skill of the partner is good and could be regarded as an important strength of the partnership, the taking in consideration of the territorial dimension of the project with its goal of sustainable development must be overpassed the only technical aspects. In that sense, an important investment in the socio-economic aspects of the project must be pushed for the second period of PROCAMED. The next exchange expected in December between Egyptian and Tunisian partner is also encouraging.



# **Annexes**

**Annexe 1 - Announcement of the workshop**

**Annexe 2 - Preliminary scientific seminar**

**Annexe 3 - List of participants**

**Annexe 4 - List of publications**



## **ANNEXE 1**

### **Announcement of the workshop**







Programme financé par  
L'UNION EUROPÉENNE



*Project “PROCAMED” \**  
*Promotion of innovative systems in Camel breeding for  
sustainable development in Egypt and Tunisia*



**WORKSHOP**

“The dromedary camel as a domestic producing animal”  
Monday 28 October 2013 ‘AULA MAGNA’ - Plexus of Veterinary Medicine,  
Valenzano (Ba) Italy

**PROJECT INTERMEDIATE SEMINAR**

29-31 October 2013, Bari - Italy  
Conference Room, Polo Museale Monastero San Benedetto, Conversano (BA),  
Italy

**TRAINING COURSE**

“Dromedary Camel Health and Diseases and  
Veterinary Cooperation in Developing Countries”  
4-6, Nov 2013, Section of Veterinary Clinics and Animal Production (DETO)  
Valenzano (BA), Italy

**Info organization:**

Prof Giovanni Michele Lacalandra:

giovannimichele.lacalandra@uniba.it Tel. +39-080-4679879 - Fax: +39-080-4679883

Dr. Davide Monaco:

monaco\_davide@libero.it

## WORKSHOP

### **“The dromedary camel as a domestic producing animal”**

**Monday 28 October 2013 ‘AULA MAGNA’ - Plexus of Veterinary Medicine, Valenzano (Ba), Italy**

09:00 - 09:30	<b>Prof. Giovanni M. LACALANDRA</b> , University of Bari Aldo Moro, Italy: <i>“PROCAMED Project” - Welcome Address Authorities</i>
09:30 - 10:00	<b>Dr. Bernard FAYE</b> , Project Leader; French Coordinator, Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier, France: <i>“Role, distribution and perspective of camel breeding in the third millennium economies”</i>
10:00 - 10:20	<b>Prof. Mrs. Elena CIANI</b> , University of Bari Aldo Moro, Italy <i>“Breeds and genetic studies on dromedary camels”</i>
10:20 - 10:40	<b>Prof. Touhami KHORCHANI</b> , Institut des Régions Arides (IRA), Médenine, Tunisia: <i>“Dromedary camel breeding systems and productions”</i>
10:40 - 11:00	<b>Prof. Salvatore DESANTIS</b> , University of Bari Aldo Moro, Italy <i>“Gross anatomy and features of female and camel male genitalia”</i>
11:00 - 11:30	Coffee break
11:30 - 11:50	<b>Dr. Mrs. Barbara PADALINO</b> , University of Bari Aldo Moro, Italy: <i>“Male camel behavior and breeding management strategies”</i>
11:50 - 12:10	<b>Prof. Khalid Ahmed EL BAHRAWY</b> , Desert Research Center (DRC), Alexandria, Egypt: <i>“Male reproductive physiology, semen collection, handling, evaluation, and freezing”</i>
12:10 - 12:30	<b>Dr. Davide MONACO</b> , University Aldo Moro of Bari <i>“Female reproductive physiology, follicular dynamic monitoring and artificial insemination”</i>
12:30 - 12:50	<b>Prof. Mrs. Maria Elena DELL’AQUILA</b> , University of Bari Aldo Moro, Italy <i>“Assisted reproductive technologies for camels: state of art and perspectives”</i>
12:50 - 13:20	<b>Prof. Giovanni M. LACALANDRA</b> : Discussion and Workshop Closure.

## PROJECT INTERMEDIATE SEMINAR

29-31 October 2013, Bari - Italy

Conference Room, Polo Museale Monastero San Benedetto, Conversano (BA), Italy

### **Tuesday 29**

09:30 - 13:00

**Opening and Welcome Authorities.**

**Steering Committee Meeting** "Presentation of developed activities and 2013-2014 program":

**Dr. Bernard FAYE**, Project Leader; French Coordinator, Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Montpellier, France

**Prof. Giovanni M. LACALANDRA**, Italian coordinator, University of Bari Aldo Moro, Bari.

16:00 - 19:30

**Steering Committee Meeting** "Presentation of developed activities and 2013-2014 program":

**Prof. Khalid Ahmed EL BAHRAWY**, Egyptian coordinator, Desert Research Center, Alexandria, Egypt.

### **Wednesday 30**

09:30 - 13:00

**Steering Committee Meeting** "Presentation of developed activities and 2013-2014 program":

**Prof. Touhami KHORCHANI**, Tunisian coordinator, Institut des Régions Arides, Medenine, Tunisia.

16:00 - 19:30

**Steering Committee Meeting** "Project management and financial aspects":

**Dr. Mrs. Sophie JANSSEN** (CIRAD) Project Financial Manager.

**Dr. Fabrizio FLORIS**, AGC- Sardinia Region

**Steering Committee Meeting**

General discussion: "Encountered problems and project implementation"  
Seminar closure.

### **Thursday 31**

08:30 - 19:00

**Excursions and Visits:**

The Historic Center of Conversano. Trulli of Alberobello (*Unesco Heritage*).

## TRAINING COURSE

### “Dromedary Camel Health and Diseases and Veterinary Cooperation in Developing Countries”

4-6 November 2013, Valenzano-Bari, Italy

#### Monday 4

- 09:30 - 10:30 **Prof. Giovanni Michele Lacalandra** (University of Bari Aldo Moro).  
**Prof. Canio Buonavoglia** (University of Bari Aldo Moro).  
“Training Course presentation and welcome message”
- 10:30 - 11:00 **Dr. Simenew Keskes Melaku** (DVM, Addis Ababa University):  
“The most important diseases of dromedary camel” Part 1
- 11:00 - 11:30 Coffee break
- 11:30 - 13:00 **Dr. Simenew Keskes Melaku** (DVM, Addis Ababa University):  
“The most important diseases of dromedary camel” Part 2
- 13:00 - 15:30 Lunch
- 15:30 - 17:00 **Dr. Maurizio Dioli** (DVM, PhD, Camel Expert): “A field based photographic overview of the main pathologies of the camel (*Camelus dromedarius*) with notes on diagnosis and treatment”
- 17:00 - 18:00 Discussion

#### Tuesday 5

- 09:30 - 11:00 **Dr. Maurizio Dioli** (DVM, PhD, Camel Expert):  
“A field based photographic overview of the main pathologies of the camel (*Camelus dromedarius*) with notes on diagnosis and treatment” Part 1
- 11:00 - 11:30 Coffee break
- 11:30 - 13:00 **Dr. Maurizio Dioli** (DVM, PhD, Camel Expert):  
“A field based photographic overview of the main pathologies of the camel (*Camelus dromedarius*) with notes on diagnosis and treatment” Part 2
- 13:00 - 15:30 Lunch
- 15:30 - 17:00 **Dr. Maurizio Dioli** (DVM, PhD, Camel Expert):  
“A field based photographic overview of the main pathologies of the camel (*Camelus dromedarius*) with notes on diagnosis and treatment” Part 3
- 17:00 - 18:00 Discussion

#### Wednesday 6

- 09:30 - 11:00 **Dr. Mabrouk M. Seddik** (DVM, PhD, IRA Medenine, Tunisia) “  
Dromedary camel skin diseases” and “Nutritional deficiency related diseases”
- 11:00 - 11:30 Coffee break
- 11:30 - 13:00 **Dr. Massimo Scacchia** (DVM, PhD, IZSAM Teramo):  
“International cooperation and governmental agencies the IZSAM experience: Veterinary Laboratories importance in the improvement of Public Health in the South of the World” Part 1
- 13:00 - 15:30 Lunch
- 15:30 - 17:00 **Dr. Massimo Scacchia** (DVM, PhD, IZSAM Teramo):  
“International cooperation and governmental agencies the IZSAM experience: Veterinary Laboratories importance in the improvement of Public Health in the South of the World” Part 2
- 17:00 - 18:00 Discussion

## **ANNEXE 2**

### **Preliminary scientific seminar**









## **ANNEXE 3**

### **List of participants**



**Project "PROCAMED" \***  
**Promotion of innovative systems in Camel breeding for sustainable development in Saharien Territories**



**WORKSHOP**  
**"The dromedary camel as a domestic producing animal"**  
**Monday 28 October 2013 'AULA MAGNA' - Veterinary Medicine, Valenzano (Ba), Italy**

**PROJECT INTERMEDIATE SEMINAR**  
**29-31 October 2013, Bari - Italy**  
**Conference Room, Polo Museale Monastero San Benedetto, Conversano (BA), Italy**

**LIST OF PARTICIPANTS**

N	Delegates	Country	Signature
1	Prof. Lacalandra Giovanni Michele	Italy, DETO	
2	Prof. Mrs. Dell'Aquila Maria Elena	Italy, DETO	
3	Dr. Monaco Davide	Italy, DETO	
4	Dr. M.me Ciani Elena	Italy, DETO	
5	Prof. Desantis Salvatore	Italy, DETO	
6	Dr. M.me Padalino Barbara	Italy, DMV	
7	Dr Martino Nicola	Italy, DETO	
8	Dr Filioli Manuel Uranio	Italy, DETO	
9	DR Accogli Gianluca	Italy, DETO	
10	Dr. Faye Bernard	France, CIRAD	
11	M.me Janssen Sophie	France, CIRAD	
12	Dr. M.me Gaukhar Konuspayeva	Khazakistan, KazNU	
13	Prof. Dr. El Bahrawy Khalid Ahmed	Egypt, DRC	
14	Prof. Dr. El Shareer Hassan Mohamed	Egypt, DRC	
15	Prof. Dr. Abd El Fattah Mohamed Tarek	Egypt, DRC	
16	Dr. Rateb Sherif Abd El Razak	Egypt, DRC	
17	Prof. Khorchani Touami	Tunisia, IRA	
18	Dr. Mohammed Hammadi	Tunisia, IRA	
19	Dr. Yahyaoui Habib	Tunisia, IRA	
20	Dr. Ben Salem Farah	Tunisia, IRA	
21	Dr. Moslah Mekki	Tunisia, IRA	
22	Dr. Harizi Taoufik	Tunisia, IRA	
23	Dr. Jaouad Mohamed	Tunisia, IRA	

## **ANNEXE 4**

### **List of publications (on November 2013)**



## List of publications (on November 2013)

### 2.1 Improving productivity through application of modern reproductive technologies

- Monaco D., Fatnassi M., Padalino B., Kchira B., El Bahrawy K., Rateb S., Khorchani, T., Hammadi M., Lacalandra G.M. The experimental semen collection centres for dromedary camels in Egypt and Tunisia: current situation and future developments. 11<sup>th</sup> Congress of the Italian Society of Animal Reproduction, June 19---22, 2013, Ustica, Italy. **[DPA+IRA+DRC]**.
- Padalino B, Fatnassi M, Monaco D, Hammadi M, Khorchani T, Lacalandra GM. 2013. A new ethogram for evaluating housed male dromedary camel behavior and libido. 11<sup>th</sup> Congress of the Italian Society of Animal Reproduction, June 19-22, 2013, Ustica, Italy. **[DPA+IRA]**.
- Accogli G, Monaco D , El Bahrawy KA, El-Sayed A, Ciannarella , Beneult B, Lacalandra GM, Desantis S (2013). Morphological and glycan features of the dromedary oviduct epithelium. [ABSTARCT]. IX CONGRESSO NAZIONALE, Associazione Italiana Morfologi Veterinari, Abstract delle comunicazioni scientifiche, Roma, 2013. **[DPA+DRC]**.
- El-Bahrawy, K. A., Khalifa, M.A. and S. A. Rateb (2013). Recent advances in dromedary camel reproduction: an egyptian field experience. The conference of “sustainability of camel populations and production” 17th to 20th of February, 2013, King Faisal University, El Ehsaa, Saudi Arabia.**[DRC]**.
- Rateb, S.A.; Zaglol, A.A.; M.A. Khalifa and El-Bahrawy, K.A. (2012). Recent Advances and Modern Assisted Reproductive Technologies in Camels: A Review. International Workshop on Recent Strategies in Animal Production, November 5-7, 2012, Egypt, Pp. 181-192. **[DRC]**.
- Accogli G, Monaco D, El Bahrawy KA, El-Sayed A, Ciannarella F, Beneult B, Lacalandra GM, Desantis S (2013). Pregnancy induces changes in sialoglycoproteins expressed of dromedary oviduct. The conference of “sustainability of camel populations and production” 17th to 20th of February, 2013, King Faisal University, El Ehsaa, Saudi Arabia. **[DPA+DRC]**.
- Russo R, Monaco D, Rubessa M, El Bahrawy KA, El-Sayed A, Martino NA, Beneult B, Ciannarella F, Dell'Aquila ME, Lacalandra GM, Filioli Uranio M\_(2013). Confocal fluorescence assessment of bioenergy/redox status of dromedary camel oocytes before and after in vitro maturation. The conference of “sustainability of camel populations and production” 17th to 20th of February, 2013, King Faisal University, El Ehsaa, Saudi Arabia. **[DPA+DRC]**.
- Confocal fluorescence assessment of bioenergy/redox status of dromedary camel oocytes before and after in vitro maturation. **[DPA+DRC]----in press**
- Morphological and glycan features of the camel oviduct epithelium. **[DPA+DRC]----in press**
- Fatnassi M, Padalino B, Monaco D, Khorchani T, Lacalandra GM, Hammadi M. 2013. Evaluation of sexual behavior of housed male camels (*Camelus dromedarius*) through female parades: correlation with climatic parameters. Trop. Anim. Health Prod. **[IRA+DPA]**.

- Dhaoui A. 2013. La reproduction chez la chamelle laitière en système intensif: activité sexuelle et synchronisation des chaleurs. Mastère : lutte contre la désertification et gestion durable des ressources en milieu arides. INA Tunisie, 51 p [IRA+DPA].

## **2.2. Camel genetic characterization.**

- Yahyahoui H, El Sherbeny E.A.M., Gaouar SBS, Almathen F, Burger P., Lacalandra GM, Ciani E. Toward a genetic characterization of North African camel (*Camelus dromedarius*) populations through STR markers. *11th Congress of the Italian Society of Animal Reproduction, June 19--22, 2013, Ustica, Italy* [DPA+IRA+DRC]
- Nouairia, G., Yahyaoui, M.H., Khorchani, T. Amplification of alpaca tetranucleotide microsatellite markers in dromedary camel (*Camelus dromedarius*). International Conference of “ Sustainability of camel populations and production” 17<sup>th</sup> - 20<sup>th</sup> February, 2013, King Faisal University, El Ehsaa, Saudi Arabia. [IRA].

## **2.4. Improving the health status of camel herds.**

- Comparison among different methods yielding DNA from *Brucella melitensis* 16M. [DRC] -in press.
- The effect of *Trypanosoma evansi* infection in camels and in rats vaccinated against *Pasteurella* sp. [DRC] -in press.
- Parasitic, Rickettsial and Bacterial Pathogens Transmitted by Ticks in Matrouh Governorate, Egypt. [DRC] -in press.
- Parasitological and PCR Detection of *Trypanosoma evansi* in Maghrabi Camels in North West Coast in Egypt. [DRC] -in press.
- Seddik M.M., Fkih H. and Zarroug R. **2013**. Coprological diagnosis of infections with internal parasites in camels in south-eastern of Tunisia. The conference of “Sustainability of camel populations and production” 17<sup>th</sup> - 20<sup>th</sup> of February, 2013, King Faisal University, El Ehsaa, Saudi Arabia. [IRA].
- El-Kacer F. 2013. Contribution à l'étude de la dynamique d'infestation du dromadaire par les tiques au Sud de la Tunisie. Thèse de doctorat en médecine vétérinaire ENMV Sidi-Thabet. [IRA].
- ZEMZMI N. et BEN TALEB O. 2013. Contrôle de l'infestation par des strongles digestifs chez le dromadaire. Projet de fin d'Etudes License appliqué ISBAM
- Effet de traitement antihelminthique sur la cinétique d'infestation des dromadaires par les strongyloses digestifs (article en préparation). [IRA].

## **2.6. Manufacturing of new camel milk products**

- Influence of proteins cross-linking enzymes on soft cheese properties made from camel's milk. [DRC]-----in press.
- Improve sensory quality and textural properties of fermented camel's milk fortified with dietary fiber. [DRC] -----in press.
- Nasri W. 2013. Fermentation spontanée du lait de chamelle: dénombrement, isolement et identification des bactéries lactiques. Mastère : lutte contre la désertification et gestion durable des ressources en milieu arides. INA Tunisie, 60 p [IRA].

## **2.7. Enhancing the value of hides and leather**

- Harizi, T., Dhoub, S., Msahli, S., Moslah, M., Hammadi, M., Sakli, F., Khorchani, T. 2012. Surface Morphology Investigation of Tunisian Dromedary Hair. Third Conference of Isocard: Muskat- Sultanate Oman, 29-01/01-02-2012; pp. 153-154.
- Moslah, M., Hammadi, M., Harizi, T., Khorchani, T. (2013). Machine Separation between Guard and Fine Fibre of Camel. Conference of sustainability of camel population and production: college of agricultural and food sciences, king Faisal University; Al-Ahsa, Saudi Arabia; 17-20 February 2013; pp. 164.
- Harizi T. and Moslah, M., (2013). Evaluation of Fleece production washing yield and down hair yield of Tunisian dromedary. Conference of sustainability of camel population and production: college of agricultural and food sciences, king Faisal University; Al-Ahsa, Saudi Arabia; 17-20 February 2013; pp. 163.

## **3.1. Economic status of breeding camels in the Bedouin economy and development**

- Shafey, H.; Sohair A. Azmy; Osman, S. A. ; Gawish, H.; **El-Bahrawy, K. A.** (2013). Factors affecting camel breeders' knowledge and their acceptability to related modern technologies in some districts of Matrouh governorate. Camel cultures: historical traditions, present threats, and future prospects' 29–30 April 2013. The School of Oriental and African Studies (SOAS) London, UK. **[DRC]**.
- Tardif N. 2013. Contribution du dromadaire dans l'économie des ménages du sud tunisien. Rapport de stage Mastère 2. Mastère Ecologie et biodiversité. Université Montpellier France. **[CIRAD+IRA]**.
- Tardif N., Jaouad M. Faye B. 2014. Contribution of camel breeding in the household economy southeast of Tunisia. Joint Meeting of Mountain Pastures, Mediterranean Forage resources and mountain cheese Networks. JM FAO CIHEAM. June 24-26 2014. Clermont Ferrand, France. **[CIRAD+IRA]**.
- Jaouad M., Benslimen H., Sadraoui R. 2014. La production de viandes rouges au sud-est de la Tunisie : Esquisse typologique des producteurs. Joint Meeting of Mountain Pastures, Mediterranean Forage resources and mountain cheese Networks. JM FAO CIHEAM. June 24-26 2014. Clermont Ferrand, France. **[IRA]**.
- Salmi C., Jaouad M., Sadraoui R. 2014. Etude du système de commercialisation des viandes rouges dans le Sud de la Tunisie : cas du Gouvernorat de Médenine. Joint Meeting of Mountain Pastures, Mediterranean Forage resources and mountain cheese Networks. JM FAO CIHEAM. June 24-26 2014. Clermont Ferrand, France. **[IRA]**.

## **Activity 4: Sustainable management of camel breeding territories**

- Gasmi A. 2013. Cartographie et étude des potentialités productives des formations végétales des parcours El-Bahaier. Mastère de Recherche FS Gabès, 60 p.

## **Activity 5: Information and Communication**

- M. T. Badawy, B. Faye, T. Khorchani, **K.A. El Bahrawy**, G.M. Lacalandra. (2013). Improving camels productivity for sustainable development in the Mediterranean South Basin countries (Egypt and Tunisia): The ENPI-CBC-MED project "PROCAMED". The scientific conference of camel research and production. 17-19 April, 2013, Khartoum, Sudan. **[CIRAD+DPA+IRA+DRC]**.